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Effects of centralized isolation vs. home isolation on psychological distress in patients with COVID-19

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ABSTRACT

Objective: This study aimed to evaluate the impact of isolation form on the recovery of psychological distress in patients with coronavirus disease 2019 (COVID-19) after being discharged from hospital.

Methods: Baseline survey was conducted from February 10, 2020 to February 25, 2020 in patients with COVID-19 in a designated hospital on the discharge day. After discharge, patients were free to choose whether isolate in a centralized isolation site (i.e. designated hotel) or their own home for another two weeks. A follow-up survey was conducted at the end of the 2-week post-discharge isolation. Depression, anxiety as well as self-rated health were assessed at both time points using the 9-item patient health questionnaire, 7-item generalized anxiety disorder scale and self-rated health scores, respectively.

Results: Fifty centrally isolated and 45 home isolated patients completed both the baseline and the follow-up assessments. Significant effects of time and time by isolation form were found on depression and anxiety levels, with a significant decrease in depression and anxiety shown in home isolated but not in centrally isolated patients. Besides, a significant time effect was identified on self-rated health with significant improvement found in home isolated but not in centrally isolated patients.

Conclusions: Home isolation is superior to centralized isolation in the recovery of COVID-19-associated depression, anxiety as well as self-rated health. More attention needs to be paid to the psychological well-being of centrally isolated patients. A sustained and integrated rehabilitation plan is warranted for patients with COVID-19 to achieve both physical and psychological recovery.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a highly contagious disease caused by a novel strain of coronavirus, designated as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. As of December 2020, the virus has resulted in over 80 thousand confirmed cases in China and 80 million cases in more than 200 countries worldwide [2]. Yet, no specific treatment has been proven to be effective for COVID-19 [3]. The huge uncertainty about the consequence of the disease as well as the isolation environment brings patients fear and anxiety and can

sometimes cause dramatic psychological effects [4].

To address the ever-increasing mental health needs in face of COVID-19 pandemic, on Jan 27th, 2020, China's Joint Prevention and Control Mechanism of the State Council (China's central authority in response to COVID-19) published guidance on mental health intervention targeting adverse mental health problems related to the COVID-19 infection [5]. The guideline stratifies the population into four different levels according to the intensity of psychological stress associated with COVID-19 infection. Patients with confirmed COVID-2019 were the first level population whose mental health needs should be proactively assessed

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Previous studies have documented the huge psychological impact of a new and dangerous pathogen on infected patients during the acute phase and aftermath [6–8]. For those who survived, studies have shown long-term psychological consequences such as anxiety, depression, and post-traumatic stress disorder (PTSD) [9,10]. Understanding how the psychological distress caused by COVID-19 infection can be mitigated is of critical importance for the mental well-being of the patients. Several factors such as individuals' resilience, safety, calming, connectedness, sense of efficacy, and hope were suggested to play important roles during the recovery stage from a catastrophe in empirical reviews [11,12]. Yet, no prior study has specifically examined the effect of isolation form on the recovery of psychological distress in patients who have suffered a pandemic infectious disease.

In China, patients who recovered from COVID-19 have to be under strict isolation for another two weeks after they were discharged from hospitals. Before the implementation of new quarantine arrangements in March 2020, patients with cured COVID-19 in Changsha could choose to stay at centralized isolation sites (i.e., designated hotels) or at home. Theoretically, both ways have their advantages and disadvantages in the recovery of COVID-19-associated psychological distress. Patients who were at home-isolation could stay in their known surroundings which poses as a mental relief for them. In addition, they could get closer support and care from their own family members. However, the home-isolation could also bring stigmatization from the local district and may bring fear of passing the virus onto their family members. While centralized isolation enables closer monitoring and easier access to medical resources. It may bring loneliness, boredom, feelings of isolation to individuals [4]. Hence, it is interesting to examine the effect of different isolation forms on the mental status of cured patients through an empirical investigation. In this study, we assessed the level of depression, anxiety, and self-rated health in cured patients with COVID-19 before and after post-discharge isolation, aiming to investigate the impact of isolation form on the psychological well-being of patients with a pandemic infectious disease.

2. Methods

2.1. Participants and inclusion criteria

This study was approved by the ethics review committee of The First Hospital of Changsha. COVID-19 patients were recruited from The First Hospital of Changsha (Hunan, China), the exclusive designated hospital for COVID-19 treatment in Changsha. From January 17th to February 24th, 251 patients with COVID-19 were admitted to the hospital.

We conducted a longitudinal questionnaire survey from February 10 to April 2, 2020. The inclusion criteria of participants were: 1) ≥ 18 years old (one adolescent aged 15 were included and consents were obtained from his parents); 2) able to give oral consent and sign electronic informed consent; 3) able to use mobile devices to complete the questionnaires; 4) diagnosed with COVID-19 according to National Clinical guidelines released by the China National Health Commission [13].

2.2. Study procedure

This is a longitudinal observational study. First, on the discharge day, nurses in isolation wards would inform the patients with the objectives and processes of this study. Oral consent was obtained from all the participants at this step. Next, participants were provided with a website link to fill in the questionnaires and scales. Electronic informed consent clarifying the purpose of the research was provided before the investigation began. After being discharged, patients were free to choose whether isolate in a designated hotel (centralized isolation group, "CEN" group) or at home (home isolation group, "HOM" group) for 2 weeks. A follow-up survey with the same contents and procedure was conducted

at the end of the 2-week isolation. Signed informed consent authorizing publication have been obtained from all the participants.

2.3. Assessments

The online questionnaires collected the following information at baseline: (1) Demographic characteristics, including age, gender, marital status, education; (2) Health-related information, including comorbidity of chronic physical conditions and comorbidity of mental disorders; (3) Self-rated health. The self-rated health a subjective assessment of the patients' present general health [14]. We used a single-item — "In general, how would you rate your current health status (0 = 'very unhealthy' and 10 = 'very healthy')?" — to assess patients' self-ratings of health. The self-rated health is a valid and reliable measure and is extensively used in the public health field [15]; (4) Symptoms of depression were measured by 9-item Patient Health Questionnaire (PHQ-9; Range, 0–27) [16]. The PHQ-9 is widely used as a depression screening tool in primary care [16]. The Chinese version of PHQ-9 has good reliability and validity in general hospital inpatients [17]. (5) Symptoms of anxiety were measured by 7-item Generalized Anxiety Disorder scale (GAD-7; Range, 0–21) [18]. The GAD-7 is used for screening generalized anxiety disorder (GAD) in primary care settings [18]. The Chinese version of GAD-7 has good reliability and validity in general hospital inpatients [19]. At follow-up, depression, anxiety symptoms as well as self-rated health were re-assessed by online survey.

To control the confounding influence of COVID-19-related variables and mental health support on depression and anxiety, as well as self-rated health, we also collected information about COVID-19 and mental health service utilization of the patients. The COVID-19-related information includes the duration of hospitalization, and the disease severity. The disease severity was defined according to National Clinical guidelines published by China's National Health Commission [13] based on the international criteria [20]. Severe cases should meet one of the following criteria: respiratory rate ≥ 30 breaths/min, $\text{SaO}_2 < 93\%$, $\text{PaO}_2/\text{FiO}_2 < 300$ mmHg, or rapid progress of disease defined as an increase of infection $\geq 50\%$ in 48 h as shown by pulmonary imaging. The mental health service utilization information was categorized as received or not received online or telephone supportive counseling during isolation.

2.4. Statistical analysis

All analyses were conducted in SPSS Version 25.0. Data distributions were identified by probability plots. Continuous variables were presented as median and interquartile range or mean and standard deviation as appropriate. Categorical variables were presented as frequency and percentages in each category. Mann–Whitney *U* test was employed to compare abnormally distributed continuous variables and student *t*-test was used to compare normally distributed continuous variables between groups. Chi-squared test was adopted to compare categorical variables between different groups. General Linear Model Repeated Measure (GLM-RM) was used to examine the effects of time and time by isolation form on depression, anxiety, and self-rated health scores. Depression, anxiety, and self-rated health scores at baseline and follow-up time points were included as the repeated measures outcome variables and the isolation form (centralized isolation vs home isolation) was included as the between-subject variable in the GLM-RM model. Besides, demographics (age, gender, education), disease-related measurements (severity of the pneumonia and duration of hospitalization), and supportive counseling during isolation (received or not) were included as covariates and checked for significance. In addition, Least-significant-difference post hoc tests were used to detect the differences of depression, anxiety, and self-rated health scores within the CEN and HOM groups, and between baseline and follow-up.

3. Results

3.1. Study overview

Questionnaires were delivered to 183 patients on the discharge day. Twenty-seven patients did not consent and 10 patients did not finish the questionnaire. Eventually, 146 patients participated in the study at baseline. The overall response rate was 79.8% in the baseline survey. At follow-up, 51 patients were dropped out for the following reasons: 11 patients did not answer the phone; 7 patients gave the wrong phone number; 28 patients did not consent; 5 patients agreed to take part in the study but did not finish the questionnaire. Eventually, 95 patients completed the follow-up assessments, which were included in our data analyses. The overall response rate was 81.6% in the follow-up survey. The procedure of participant recruitment was presented in Fig. 1.

3.2. Demographic and psychological characteristics of the CEN and HOM groups

There was no significant difference in the baseline demographics and clinical characteristics between the patients who followed up ($n = 95$) and who dropped out ($n = 51$) during the follow-up time point (Supplemental Table 1). Among the 95 patients included in the analysis, 50 patients chose to go to a designated hotel (CEN group) and 45 chose to isolate at home (HOM group). Forty-eight patients (21 in the CEN group and 27 in the HOM group) received supportive counseling during their isolation. The baseline characteristics of the two groups are shown in Table 1. There were no significant differences in demographics (i.e., age, gender, education, marital status) or clinical variables (i.e., comorbidities, duration of hospitalization, and the severity of pneumonia) between the CEN and HOM groups.

Self-reported measures were presented in Table 2. Both PHQ-9 and GAD-7 scales showed good internal consistency with Cronbach's Alpha reached 0.923 for PHQ-9 and 0.943 for GAD-7. Thirty-eight (40.6%) and 41 (43.7%) participants respectively reported at least mild depression and anxiety symptoms at baseline. Most of the participants considered that they were in a fairly good health condition with self-rated health reached a median of 7 out of 10 points. At follow-up, 29 (31.2%) and 36 (38.5%) participants respectively reported at least mild depression and anxiety symptoms. Median of self-rated health reached 8 points during follow-up. There were no significant differences in depression levels, anxiety levels, as well as self-rated health between the CEN and HOM

groups at baseline or follow-up (Table 2).

3.3. Effects of isolation form on depression, anxiety, and self-rated health over time

Changes of PHQ-9, GAD-7 and self-rated health scores across time in the CEN and HOM groups were shown in Fig. 2. The scatter plot of individual changes of PHQ-9, GAD-7, and self-rated health were presented in Fig. 3.

Since none of the covariates (demographics, disease-related measurements and supportive counseling during isolation) was significant in the GLM-RM model, they were all removed from the final model. Therefore, the effects of time and time by isolation form were tested for significance. GLM-RM analysis revealed a significant effect of time on depression levels ($F = 8.825$, $P = 0.004$), demonstrating a significant decrease in depression scores from baseline. In addition, there was a significant interactive effect of time by isolation form on depression levels ($F = 6.241$, $P = 0.014$). Post hoc analysis showed that there was a significant decrease of depression scores in the HOM group ($t = 3.769$, $P = 0.001$) but not in the CEN group ($t = 0.343$, $P = 0.73$).

Similarly, GLM-RM analysis identified a significant effect of time on anxiety scores ($F = 9.958$, $P = 0.002$), revealing a significant decrease in anxiety scores from baseline. The time by isolation form was also significant on anxiety scores ($F = 4.936$, $P = 0.029$). Post hoc analysis showed a significant reduction of anxiety scores in the HOM group ($t = 3.703$, $P = 0.001$). However, there was no significant change in anxiety scores in the CEN group ($t = 0.679$, $P = 0.50$).

GLM-RM analysis showed a significant effect of time on patients' self-rated health ($F = 12.252$, $P = 0.001$), demonstrating a significant increase in score of self-rated health at follow-up time point. There was no significant effect of time by isolation form on self-rated health ($F = 2.027$, $P = 0.16$). Post hoc analysis showed that patients in the HOM group had a significant increase in self-rated health ($t = 3.441$, $P = 0.001$). However, patients in the CEN group did not show a statistically significant increase in self-rated health ($t = 1.363$, $P = 0.18$).

4. Discussion

This is the first longitudinal study examining the effects of isolation form on the recovery of psychological distress and self-perceived health over time in patients with cured COVID-19. Our results revealed that home isolated patients have greater improvement in depression and

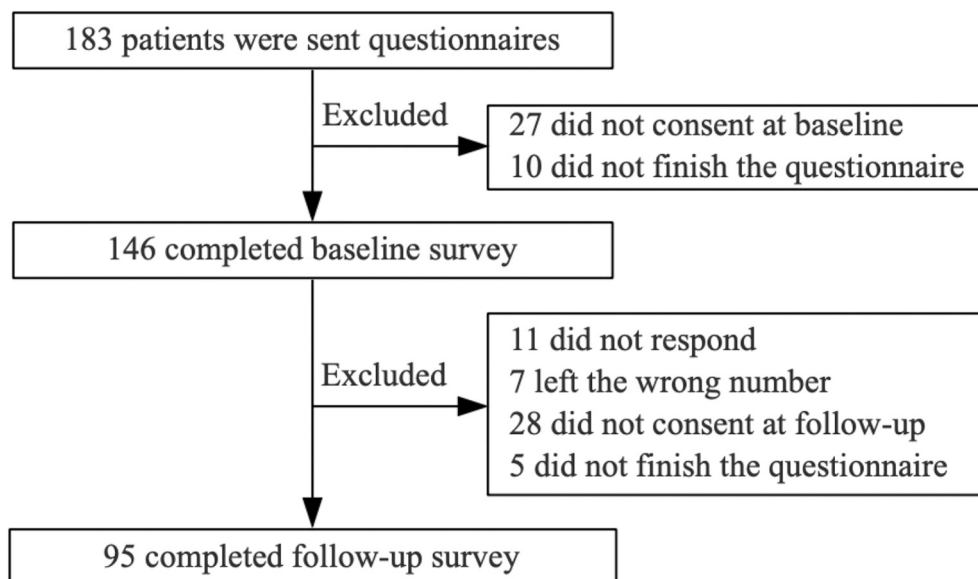


Fig. 1. Flow chart of participants recruitment and follow-up.

Table 1
Demographic and clinical characteristics of the CEN and HOM groups.

Participant characteristics	Total	Centralized isolation (n = 50)	Home isolation (n = 45)	Z/t/ χ^2	P value
Age (Median, IQR)	39 (30–47)	38 (30–43)	40 (30.5–51.5)	1.104	0.27 ^a
Gender (n, %)				0.004	0.95 ^b
Male	51 (53.7%)	27 (54.0%)	24 (53.3%)		
Female	44 (46.3%)	23 (46.0%)	21 (46.7%)		
Marital status (n, %)				0.220	0.64 ^b
Unmarried or divorce	21 (22.1%)	12 (24.0%)	9 (20.0%)		
Married	74 (77.9%)	38 (75.0%)	36 (80.0%)		
Education (n, %)				2.449	0.24 ^b
High school or below	28 (29.5%)	12 (24.0%)	16 (35.5%)		
Bachelor	55 (57.9%)	33 (66.0%)	22 (48.9%)		
Master or above	12 (12.6%)	5 (10.0%)	7 (15.6%)		
Comorbidity of physical disorder (n, %)				0.129	0.72 ^b
Yes	27 (28.4%)	15 (30.0%)	12 (26.7%)		
No	68 (71.6%)	35 (70.0%)	33 (73.3%)		
Comorbidity of mental disorder (n, %)				0.245	0.62 ^b
Yes	3 (3.2%)	2 (4.0%)	1 (2.2%)		
No	92 (96.8%)	48 (96.0%)	44 (97.8%)		
Duration of Hospitalization (days, mean \pm SD)	17.5 \pm 8.1	16.2 \pm 7.0	18.9 \pm 9.0	−1.660	0.10 ^c
Severity of pneumonia (n, %)				0.715	0.40 ^b
Mild	85 (89.5%)	46 (92.0%)	39 (88.6%)		
Severe	10 (10.5%)	4 (8.0%)	6 (11.4%)		

n, number of participants.

^a P values obtained by Mann–Whitney U test.

^b P values obtained by Pearson's chi-square test.

^c P values obtained by student t-test.

anxiety levels as well as self-perceived health than centrally isolated patients. The findings indicate a superiority of home isolation over centralized isolation in the mental health of patients with cured COVID-19.

Consistent with previous studies in acute infectious diseases, more than 40% of patients suffered from psychological distress even when the COVID-19 is controlled [10,21]. The short-term recovery of psychological distress after discharge was significant as the effect of time was identified both on depression and anxiety scores. However, the improvement in psychological distress was unsatisfactory, with nearly 40% of patients still showing depression or anxiety symptoms at follow-up, especially in the CEN group. The contracting of a lethal, highly contagious pathogen is a traumatic experience for patients. Even after recovery, patients experienced depression and anxiety, which might be attributed to carry-over effects but could also stem from some emerging issues such as being discriminated against or worrying about losing jobs [22]. Given the presence of emotional distress after discharge, the need for sustained psychological support among the patients appears

Table 2
Depression, anxiety, and self-rated health in the CEN and HOM groups at baseline and follow-up.

Participant characteristics	Total	Centralized isolation	Home isolation	Z/ χ^2	P value
PHQ-9					
Baseline (median, IQR)	3 (1–7)	3 (1–5.25)	3 (1–7)	1.162	0.25 ^a
Normal (n, %)	57 (59.4%)	32 (64.0%)	25 (55.6%)	0.705	0.70 ^b
Mild (n, %)	21 (21.9%)	10 (20.0%)	11 (24.4%)		
Moderate (n, %)	7 (7.3%)	3 (6.0%)	4 (8.9%)		
Severe (n, %)	10 (10.4%)	5 (10.0%)	5 (11.1%)		
Follow-up (median, IQR)	2 (0–7)	3 (0–7)	2 (0–4)	0.235	0.81 ^a
Normal (n, %)	66 (68.8%)	31 (62.0%)	35 (77.8%)	4.067	0.13 ^b
Mild (n, %)	16 (16.7%)	12 (24.0%)	4 (8.9%)		
Moderate (n, %)	7 (7.3%)	3 (6.0%)	4 (8.9%)		
Severe (n, %)	6 (6.3%)	4 (8.0%)	2 (4.4%)		
GAD-7					
Baseline (median, IQR)	4 (0–7)	3 (0–7)	4 (0–7)	0.375	0.71 ^a
Normal (n, %)	54 (56.3%)	29 (58%)	25 (55.6%)	0.324	0.85 ^b
Mild (n, %)	25 (26.0%)	12 (24.0%)	13 (28.9%)		
Moderate (n, %)	7 (7.3%)	4 (8.0%)	3 (6.7%)		
Severe (n, %)	9 (9.4%)	5 (10.0%)	4 (8.9%)		
Follow-up (median, IQR)	2 (0–6)	3 (0–7)	1 (0–5)	1.323	0.19 ^a
Normal (n, %)	59 (61.5%)	28 (56.0%)	31 (68.9%)	1.946	0.38 ^b
Mild (n, %)	25 (26.0%)	16 (32.0%)	9 (20.0%)		
Moderate (n, %)	5 (5.2%)	1 (2.0%)	4 (8.9%)		
Severe (n, %)	6 (6.3%)	5 (10.0%)	1 (2.2%)		
Self-rated health					
Baseline (median, IQR)	7 (5–8)	7 (5–8)	7 (5–8)	0.226	0.82 ^a
Follow-up (median, IQR)	8 (7–8)	8 (7–8)	8 (7–8)	0.810	0.42 ^a
Mental health service utilization during isolation (n, %)				3.070	0.08 ^b
Received	48 (50.5%)	21 (42.0%)	27 (60.0%)		
Not received	47 (49.5%)	29 (58.0%)	18 (40.0%)		

The comparison of the number of patients in different severity of depression or anxiety was conducted after combining the patients with moderate and severe depression or anxiety.

n, number of participants.

^a P values obtained by Mann–Whitney U test.

^b P values obtained by Pearson's chi-square test.

warranted.

Some important factors have been suggested to moderate patients' psychological distress by previous studies, including individual's resilience [12,23] and disease appraisals [8,10], empathic and positive communication of doctors and nurses inside wards [24], and support from family and friends [25]. Our longitudinal observations suggest that isolation at home could be an important factor to restore patients' mental well-being. During the recovery phase, isolation in a familiar environment and probably the care from family members could bring psychological comfort to patients. Although centralized isolation may reduce worries about passing the virus onto family members, the psychological impact of quarantine in an unfamiliar environment could be a sustained stressor for patients [4,26], therefore resulting in unchanged depression and anxiety levels. When choosing isolation measures, home isolation could be a better option for patients' psychological recovery.

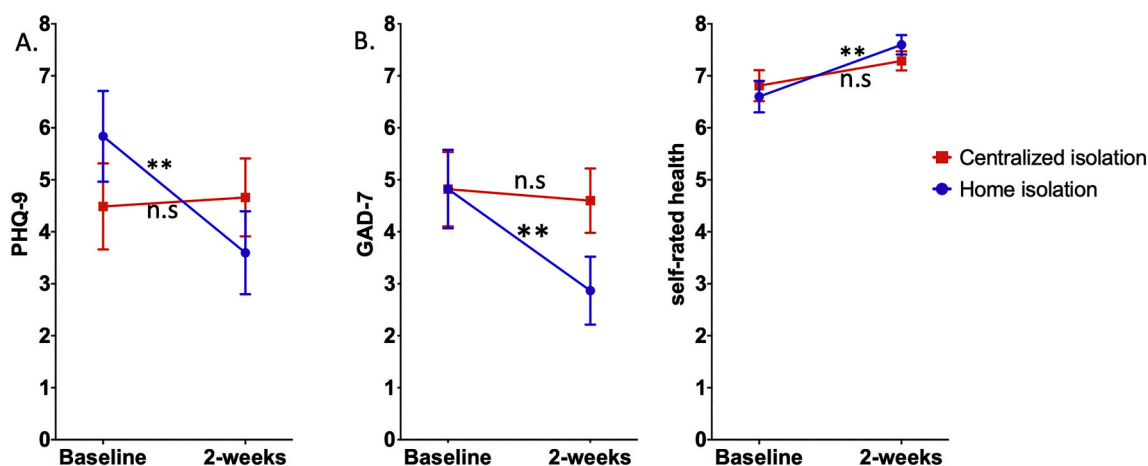


Fig. 2. Depression, anxiety, and self-rated health in the CEN and HOM groups at baseline and follow-up (error bars indicate standard errors of the variables). n.s., non-significant; *, $P < 0.05$; **, $P < 0.01$.

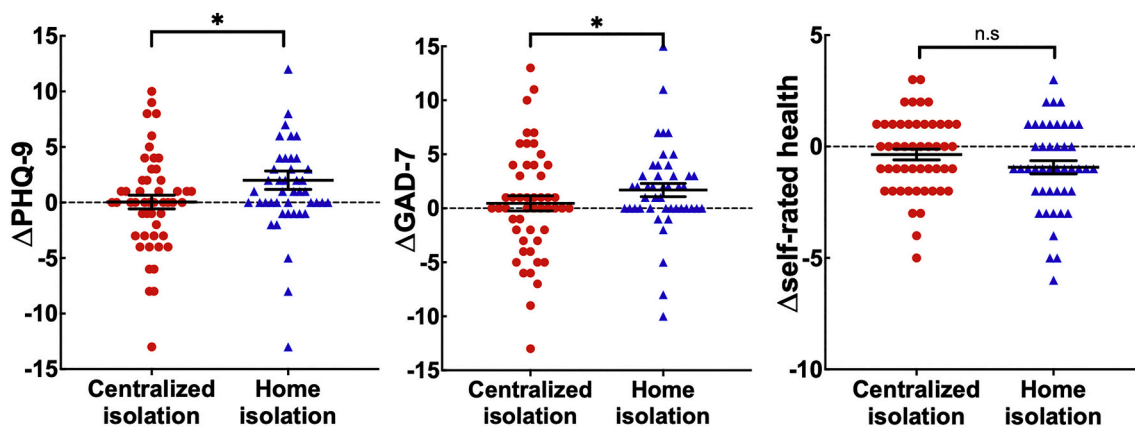


Fig. 3. Scatter plots of changes in depression, anxiety, and self-rated health in the CEN and HOM groups (error bars indicate standard errors of the means). ΔPHQ-9 = baseline PHQ-9 - follow-up PHQ-9; ΔGAD-7 = baseline GAD-7 - follow-up GAD-7; Δself-rated health = baseline self-rated health - follow-up self-rated health. n.s., non-significant; *, $P < 0.05$.

Regarding the disadvantages of centralized isolation, mental health care should be more proactively carried out in centrally isolated patients, including proper psycho-education, proactive assessments, and appropriate intervention.

We also noticed that the changes in self-rated health were significantly increased only in the HOM group. The results suggest that those in home isolation perceived higher recovery in their overall health status. The self-rated health has been shown to be affected by mental health [27]. Hence, the non-significant increase in self-rated health in centrally isolated patients might be due to non-improvement in their psychological stress. Besides, in centralized isolation, patients could feel more lonely, helpless and isolated. They might be more focused on their residual symptoms of COVID-19 in such an environment. These psychological reactions are also likely to reduce the patients' self-rated health levels. Previous studies showed that both self-rated health and mental health are associated with objective health outcomes [28]. Therefore, the care for both mental and physical health should be brought together in the rehabilitation plan [29].

Some limitations of the present study must be considered. Firstly, we only included patients in one designated hospital in Changsha. Therefore, the generalization of our findings needs to be tested in studies from other sites. Second, there was a relatively high drop-out rate in the follow-up investigation. Participants who dropped out of our studies may bring bias to our findings. Third, we did not thoroughly investigate the motives of the patients' choice of the isolation site. Patients who

chose centralized isolation may be afraid of other family members getting infected or may not be able to isolate at home. In addition, we did not include other psychological factors such as resilience and self-efficacy in our study. These factors may have an impact on the mental health improvement in COVID-19 patients. Future studies could investigate the underlying reasons for the non-improvement of psychological distress in the centralized isolation group to facilitate more specific early intervention. Lastly, patients were followed up for only two weeks, the long-term psychological impact of different isolation forms on patients remains to be investigated.

In conclusion, patients in home isolation showed more improvement in psychological distress and self-rated health than patients in centralized isolation. Our results provide preliminary evidence for the superiority of home isolation over centralized isolation in mental health recovery. More attention needs to be paid to centrally isolated patients. Policymakers and mental health professionals should come up with long-term rehabilitation programs to address the mental health issues in patients with COVID-19 after discharge from hospital.

Author statement

This paper is new and neither the entire manuscript nor any part of its content has been published or has been accepted elsewhere. It is not in submission at any other journals. All authors have approved of the final version of this manuscript.

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Declaration of Competing Interest

The authors report no conflicts of interest concerning the content of this manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychores.2021.110365>.

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